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ABSTRACT

While much research attention has focused on the direct labor market effect of minimum wage increases on employment, the impact of changes in the minimum wage on college enrollment may impact educational attainment. Using institutional data on college enrollment and program completion, we find that enrollment falls markedly among students at public two-year institutions in response to increases in the minimum wage. The largest enrollment effects are seen for those students who are enrolled part-time at community colleges. We find little evidence of negative effects on the attainment of certificates or degrees, suggesting that increases in the minimum wage are unlikely to divert students from degree attainment.

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1 Introduction

How changes in local, state, and federal minimum wage requirements impact college enrollment and attainment is theoretically ambiguous and empirically unresolved. While evidence on the employment impacts of minimum wage policies has been the subject of high-decibel debate and notable measurement innovations, impacts on post-secondary enrollment have received much less attention even as many potential college students receive wages near the statutory minimum wage.[1]

For many college students, particularly those enrolled in community colleges, working and studying go hand-in-hand. Overall, 49% of college students and 55% of students at community colleges are employed. This overlap between employment and enrollment suggests scope for adjustment—specifically trading off between the two states—in the case of a wage change.[2] Increased wages may reduce enrollment due to an increased opportunity cost of pursuing post-secondary education. On the other hand, an increase in the minimum wage may increase enrollment through reduced credit constraints for individuals who are both employed and enrolled as well as reduced employment opportunities.

Some basic empirical facts serve to motivate our analysis of the effect of minimum wage changes on college enrollment and attainment. First, there have been nearly 400 state-level changes in the minimum wage between 1986 and 2019, with 239 state-level minimum wage increases of at least 6% and 96 increases of 10% or more. Over this same period, post-secondary enrollment rose from about 15 million in 2000 to a peak of more than 21 million in 2010, before declining to 18.9 million in 2019 (De Brey et al. 2021). Enrollment changes at community colleges have

[1] The publication of David Card and Alan Krueger's Myth and Measurement in 1995, along with the related paper in the American Economic Review (1994), generated a wave of critique including a volume of response papers in the Industrial and Labor Relations Review by researchers including Richard Freeman, Dan Hamermesh, Charles Brown and Finis Welch. More recently, research papers like Dube, Lester and Reich (2010) and Cengiz et al. (2019) have brought new research designs and enhanced econometric techniques to the question of whether changes in the minimum wage impact employment, while debate over methodology, data, and results persists (Neumark, Salas and Wascher 2014).

[2] Many college students are unlikely to be impacted by minimum wage policies. These inframarginal students include those who are likely to be largely inelastic in their enrollment demand (including many of those attending full-time residential institutions).

been particularly noteworthy, rising from about 5.7 million in 2000 to 7.2 million in 2010 and then falling precipitously to 4.7 million in 2019. Finally, the employment rate of those in college grew modestly between 1990 and 2000, declined markedly during the Great Recession, and has yet to recover to pre-2008 levels.

Overlaid on these broad trends are concerns about the extent to which individual credit constraints and stagnant post-secondary funding at the state level may limit collegiate attainment and economic mobility. Analysis of the impact of the minimum wage on post-secondary enrollment and attainment addresses questions of whether increases in the minimum wage mitigate credit constraints or distort individual decision-making with respect to enrollment and employment.

This paper uses a stacked event study to estimate the impact of minimum wage increases on enrollment and attainment. Our analysis uses data from the federal administrative Integrated Post-secondary Education Data System (IPEDS) on enrollment by type of institution, intensity of enrollment, and student demographics in conjunction with a full panel of data on state educational and economic conditions. Our findings provide clear evidence that a minimum wage increase has negative enrollment effects for a subset of students. Specifically, students enrolled part-time at community colleges are most impacted by changes in the minimum wage. Conversely we find no detectable enrollment effects for students enrolled in four-year colleges. These findings, alongside null effects of the minimum wage on attainment of certificates or degrees, suggest that students for whom the minimum wage impacts enrollment are weakly attached to post-secondary institutions and unlikely to have been diverted from degree attainment by the changing minimum wage.

2 Research Background

While early research on the impact of minimum wage changes on enrollment and skill acquisition focused particularly on high school enrollment and completion (Mattila 1981; Ehrenberg and Marcus 1982; Neumark and Wascher 1995*a*,*b*), we focus on the margin of post-secondary enrollment when individuals have moved beyond the age of high school compulsory attendance.

Increases in the minimum wage can impact both labor supply and labor demand in manners that have theoretically ambiguous impacts on enrollment. On the supply side, a higher minimum wage increases the opportunity cost of enrollment and leisure activities. Some individuals may respond to this changing opportunity cost by increasing their labor supply and reducing enrollment on the intensive or extensive margin, i.e. decreasing the number of courses taken or dropping out of school.[3] For other students, a higher minimum wage may increase enrollment, for example if additional income reduces credit constraints that might otherwise limit their ability to enroll.

On the demand side, enrollment decisions necessarily depend on the extent to which a change in the minimum wage impacts employment prospects or the skill requirements of employers. Recent work by Clemens, Kahn and Meer (2021) finds that firms respond to minimum wage increases by posting jobs for more high school graduates (vs.dropouts), suggesting that students on the margin of attending community college, who have a high school diploma, may face higher labor market demand.

With more than 18.9 million students enrolled in post-secondary education in 2020 across institutions ranging from research universities to community colleges, the likelihood of heterogeneous enrollment effects should be no surprise (De Brey et al. 2021). Indeed, many students enrolled in post-secondary education are unlikely to be impacted by minimum wage changes as their existing wage exceeds the prevailing minimum wage or their enrollment demand is inelastic to changes in the minimum wage.

Community colleges serve a range of functions including job training in vocational-technical fields as well as enabling students to transfer to a BA-level program with two years of academic credit. Some students at community colleges are first-time college students while others are returning to community college enrollment after years in the labor market. Relative to students at

[3]There is some existing evidence that increasing hours of employment has negative effects on academic attainment. Stinebrickner and Stinebrickner (2003) take advantage of unique variation in which all students at a small college are required to work at least 10 hours per week, while assignment to campus jobs is random. With variation in hours above the 10-hour minimum, the authors find that an additional hour worked per week decreases the student's first semester grade point average. In addition, work by Scott-Clayton (2012) shows that participation in Federal Work-Study (FWS) is linked to significant declines in GPA and graduation rates for women, while there are some indications of positive effects for men.

four-year public institutions, students at community colleges are much more likely to attend part time (68% versus 32% in 2021, table 303.30, De Brey et al. (2021)) and are more likely to be older, with 31% of community college students being over the age of 25 relative to 18% at public four-year institutions (table 303.50, De Brey et al. (2021)).

The extent to which students mix school and employment varies with age and type of institution. Among students ages 18-24, 58% of community college students are employed (with those employed working an average of 15 hours per week) relative to about 46% of students at four-year institutions (who work an average of 10 hours per week); among students ages 25-35 nearly two-thirds of students enrolled at both two-year and four-year are employed, with these students working an average of about 23.5 hours per week (authors' calculations using the October Current Population Survey, CPS). In turn, among students combining work and enrollment at the post-secondary level, community college students are those most likely to report wages in the range of prevailing minimum wage levels. Among employed community college students, 27% earn $10 or less hourly and 59% earn $12 or less; comparable rates in 4-year institutions are 19% and 42%, respectively.

Measured Enrollment Responses: Minimum Wage Changes

The empirical study of enrollment responses to changes in the minimum wage has been addressed with mixed findings and limited data since the 1970s. Many early papers, including Neumark and Wascher (1995*a*, 2003), found evidence of changes in high school enrollment and high school completion, given the well-established incidence of high school workers often receiving the minimum wage. Yet, many high school-age students may also be subject to compulsory schooling laws, which would limit labor supply to a degree. Indeed, Chaplin, Turner and Pape (2003) find that these disenrollment effects among high school students disappear in states where enrollment is mandated until age 18.

Early studies that directly estimate the impact of changes in the minimum wage on post-secondary enrollment have grappled with limited data, which has likely contributed to inconsistent

results. Many of these studies rely on the CPS which is not only limited in its basic sample size, but also does not include questions about enrollment that identify post-secondary enrollment or distinguish type of institution for the full population over a long horizon. Until 2012, the basic monthly surveys only recorded enrollment for those younger than 24, missing many older student-workers. Only the October supplement has recorded enrollment for all respondents across all years. In other months, the only mechanism for capturing enrollment of all adults is a question on "major activity last week," asking respondents who are simultaneously employed and enrolled to choose their primary activity and contributing to measurement error in the classification of enrollment.

The use of rich administrative data sources for the measurement of enrollment and post-secondary attainment in relation to changes in the minimum wage distinguishes our research and several recent papers (Li 2022; Lee 2020) from analyses that use survey data with limited coverage of post-secondary enrollment. All colleges and universities are required to report enrollment, degree attainment, and other operational information to the U.S. Department of Education through the annual IPEDS survey modules. These institution-level data provide rich information about the types of enrollment and post-secondary experiences impacted by minimum wage changes, and they are not subject to the sampling variability that often afflicts CPS measures at state or regional geographic levels.

Focusing on transitions immediately after high school completion, recent work by Li (2022) uses administrative student-level data from California paired with the distinctive municipal/county changes in minimum wage levels in California in recent years. Li shows that students from lower-income families increase their community college enrollment in response to minimum wage increases, while students with relatively high achievement shift their enrollment to more selective four-year public institutions.

Recent research by Lee (2020) uses IPEDS enrollment data to examine enrollment responses to minimum wage changes across state borders, following the strategy of Dube, Lester and Reich (2010) who find little impact of minimum wage changes on employment. Lee (2020) finds that increases in the minimum wage led to reductions in enrollment at community colleges; these effects

appear to be concentrated among those enrolled part time. Lee finds that a 10% increase in the minimum wage predicts a 4.4-5.0% decline in enrollment overall, with part-time enrollment declining by 5.2-6.1% and no effect on full-time enrollment. Our approach, which focuses on states as the unit of analysis, differs from Lee (2020) in that we also examine enrollment at four-year institutions which tend to draw students from communities across the entire state and thus may be less appropriate for study in a border-design approach. We also differ because we directly measure impacts on educational attainment.

Our analysis of the response of post-secondary enrollment to fluctuations in the minimum wage also connects to broader questions of skill acquisition including on-the-job training (OJT). The evidence regarding OJT responses to minimum wage changes is ambiguous — both theoretically and empirically. An increase in the minimum wage may diminish OJT opportunities because the minimum wage acts as a price floor for low-skilled labor, potentially undermining this mechanism for skill acquisition (Baker 2005). This type of canonical competitive labor market model, which is consistent with evidence like Neumark and Wascher (2003), points to increases in the minimum wage reducing firms' provision of OJT, as they can no longer offset training costs through wage reductions due to the minimum wage floor. However, alternative models, exemplified by Acemoglu and Pischke (1999), posit that an increase in the minimum wage in the presence of labor market frictions may provide incentives for firms to invest in training. In their recent review article, Black, Skipper and Smith (2023) emphasize that broad empirical conclusions are limited by the low quality of OJT data and — to the extent that data exist — the limited generalizability of results across sectors. Ultimately, the central issue revolves around whether OJT and formal enrollment should be viewed as complements or substitutes in the context of labor market dynamics.

Measured Enrollment Responses: Local Labor Markets

Examination of enrollment responses to shifts in state and local labor market conditions may inform the measurement of the impact of minimum wage changes. It has long been hypothesized (and shown empirically) that collapses (or booms) in local labor markets impact enrollment deci-

sions (Betts and McFarland 1995; Barr and Turner 2013; Charles, Hurst and Notowidigdo 2018). The logic is straightforward: changes in local labor market conditions alter the opportunity cost of enrollment.

In an older analysis, Betts and McFarland (1995) show that the enrollment at community colleges is sensitive to changes in local unemployment rates, with enrollment rising appreciably for adults above and beyond recent high school graduates (a 1 percentage point change in the unemployment rate predicts a 4% increase for adults overall, relative to about 0.5% for recent high school graduates). Focusing on the variation in enrollment and local labor market conditions over an interval that included the Great Recession, Barr and Turner (2013) find that recessionary conditions and weak labor markets have a substantial impact on short-duration enrollment and training opportunities. Similar to the findings in Betts and McFarland (1995), many who choose to pursue such options are older than recent high school graduates.[4] In turn, they find that much of the increase in enrollment occurred in the sectors of higher education that are likely to be most elastic in supply: community colleges, open-access public four-year institutions, and for-profit institutions.

How changes in enrollment induced by local labor market adjustments translate to changes in attainment is of significance as it addresses whether the impacts primarily affect the timing of enrollment or more permanently alter the stock of educational attainment. Charles, Hurst and Notowidigdo (2018) examine the effects of housing booms (and busts) at the local level which differentially impacted post-secondary enrollment decisions, finding that the housing boom accounted for as much as 25% of the enrollment slowdown. Although the causal force was transitory changes in the opportunity cost of enrollment, they find that attainment effects in terms of completion of sub-baccalaureate credentials are permanent.

The analogy between minimum wage policy changes and changes in local labor market conditions as factors impacting post-secondary enrollment is straightforward yet incomplete. A higher

[4]Barr and Turner (2013) find that the response in enrollment to changes in local labor market conditions measured by the unemployment rate is greater for students in their 20s than recent high school graduates. They find a within-state change in the unemployment rate of 5 percentage points predicts a 17% increase in enrollment for those ages 20–24 and a 12% increase for those ages 18–19. See also Foote and Grosz (2020) and Stevens, Kurlaender and Grosz (2019) who find increases in career and technical enrollment in response to mass layoffs and other changes in local labor markets.

minimum wage increases the opportunity cost of schooling and likely places downward pressure on enrollment, while a higher local unemployment rate tends to decrease the opportunity cost of enrollment and likely places upward pressure on enrollment. Nonetheless, at least three factors differentiate these cases: first, weakness in local labor markets may be expected to be transitory while minimum wage changes are expected to be persistent; second, the populations impacted may not be fully overlapping; and third, a local labor demand shift necessarily has different implications for employment opportunities than a change in the minimum wage, with magnitudes depending on elasticities of supply and demand.

3 Empirical Approach

In our setting, the key empirical challenge in measuring the response of post-secondary enrollment to a change in the minimum wage is estimating the state-level counterfactual enrollment patterns in the absence of the change. To leverage changes in the minimum wage that are staggered across years and states, we take a stacked event-study approach as in Schwab, Autor and Donohue (2006) and Cengiz et al. (2019). The stacked approach treats each *relevant* minimum wage change as its own event (e), creating individual datasets for each event and estimating enrollment effects in the eight-year window around that event. Every state that is not the event-specific state in question is treated as a control state. Over this time period, many control states experience their own relevant and/or minor minimum wage increases. We control for these and for federal minimum wage changes by constructing indicator variables equal to one if a control state experiences its own minimum wage change during the pre ($-3 \leq \tau < 0$) or post ($0 \leq \tau \leq 4$) period of the eight-year treatment window. These dummies are then included in the regression specification as ω_{st} in equation 1.[5]

The event-study regression equation is then:

[5] Our results are robust to creating "clean" datasets for each event. In these "clean" datasets we define control states as those that do not experience a relevant minimum wage change in the eight year panel around event e. Control states that do experience a minimum wage increase exceeding the relevance threshold are dropped from the event-specific dataset.

$$Y_{st} = \sum_{\tau=-3}^{4} \alpha_\tau I_{st}^\tau + \mu_s + \rho_t + \omega_{st} + X_{st}\beta + \varepsilon_{st} \tag{1}$$

where Y_{st} is the outcome variable—in our main results Y_{st} is log enrollment or log degree completions in two- or four-year colleges—in state s at time t. The treatment indicator I_{st}^τ is equal to one if state s had a minimum wage increase τ years from year t. This specification controls for state-by-event effects as well as time-by-event effects. ω_{st} is a vector of indicators for any other minimum wage changes (federal, minor, or relevant) that take place within the eight panel years of dataset e, and X_{st} is a matrix of additional controls for unemployment rate, young adult population (aged 18-30), and an indicator variable equal to one if community college attendance is free to state s residents in year t. Standard errors are clustered by state, the level at which policy changes occur.

This design identifies the causal effect of a minimum wage change on post-secondary enrollment and degree completion under the assumption that, in the absence of the change, outcomes in treated and untreated states would have evolved similarly. As in the standard event-study case, this assumption cannot be directly tested, but pre-trends can be observed in the years leading up to the change. The results presented in section 5 assess the visual existence of pre-trends.

As the data are cross-sectional, we estimate the impact of a minimum wage change on year-to-year enrollment experienced by institutions in the affected state as a whole, rather than the enrollment decisions of a given student. This is an incomplete measurement of the effect of a minimum wage change, as there is room for dynamic movement by students in response to minimum wage changes. Take a student who graduates from high school the year that a state announces it will raise its minimum wage. That student may have directly enrolled in a two-year college in the absence of an increase in the minimum wage, but now she decides to take a year off to work full-time and earn income which she will use to attend college in the following year. Such a student is captured as negative enrollment in the first year after the minimum wage change ($\tau+1$), but enters as positive enrollment, matching her counterfactual state, in the measurement of the treatment effect in $\tau+2$. The results presented in section 5 use a four-year follow-up window, but the extent

to which capturing longer-run effects is desirable given our data constraints remains ambiguous.

In some cases, we replace the event-study model in equation 1 with a difference-in-differences approach. In this case, the regression equation becomes:

$$Y_{st} = \alpha POST_{st} + \mu_s + \rho_t + \omega_{st} + X_{st}\beta + \varepsilon_{st} \tag{2}$$

where $POST_{st}$ is an indicator variable equal to one for years $0-4$ in the event-study, and equal to zero for years -3 to -1. Other variables are defined as in equation 1, and standard errors are clustered at the state level.

4 Data

This study brings together institution-level data on enrollment and credential attainment with state-level indicators of minimum wage policies. We also incorporate other annual measures of state-level economic conditions and demographic characteristics. Analysis is conducted at the state-by-year level.

Post-secondary Enrollment and Credential Attainment

Post-secondary institutions report data to the Department of Education in IPEDS which includes survey modules recording enrollment and credential attainment, with some data distinguishing these outcomes by student demographics, program level, and specialization. The enrollment data span 1986-2019 and include all colleges and universities that provide eligibility for federal financial aid such as Pell grants.[6] We restrict the data to degree-granting institutions and classify institutions as "two-year" or "four-year." An institution is classified as two-year if its highest or predominant degree offered is an associate degree, and four-year if the predominant degree offered is a bachelor's degree or above, given it is not a graduate-degree only institution. Institutions for which data collection is incomplete over an extended time series include non-degree granting in-

[6] Other data constraints and limitations on the years of available data are discussed in Data Appendix B.

stitutions awarding certificates requiring fewer than two years of study, often in fields like allied health, construction and repair trades, and cosmetology.[7]

The outcomes of interest are total fall enrollment and credential completion, which are both measured at the institution level. Enrollment includes students who are enrolled either part-time or full-time, but does not indicate the students' field of degree program. Credential attainment includes certificates, associate degrees and baccalaureate (BA/BS) degrees. We distinguish institutions by their control: public, non-profit, and for-profit / proprietary. Public institutions capture the majority of total enrollment at degree-granting institutions (72% in 2021, table 303.55 (De Brey et al. 2021)). For sub-baccalaureate institutions, public institutions ("community colleges") hold an even larger share of market share with these institutions enrolling more than 95% of students in 2021 at the two-year level. These institutions are particularly likely to serve students who would be most impacted by minimum wage changes. We aggregate institution-level measures to the state, which is our unit of analysis.

For a number of reasons, we focus our analysis on post-secondary outcomes of public colleges and universities. Private, non-profit post-secondary institutions disproportionately serve full-time students (75.2%) at four-year (99.3%) colleges and universities, making their enrollments likely less sensitive to state-level changes in minimum wage policies. Further, while for-profit post-secondary institutions often target students who combine employment and enrollment and thus may also be impacted by changes in minimum wage policies, the measurement of enrollment at these institutions is of low quality, particularly prior to 2000. Moreover, the appropriate assignment of enrollment to the state in which educational delivery occurred is often inconsistent, particularly before 2008 as institutions like the University of Phoenix served students in multiple states but reported enrollment under a single institutional code tied to one state (Jaquette and Parra (2014) ; Fuller (2011)).

[7]Cellini and Goldin (2014) presents a detailed analysis of these institutions and the associated measurement challenges; exclusion of outcomes from non-degree granting institutions is not for lack of potential relevance but because reliable data are not available by state and year. Still, the quantitative impact of the exclusion of enrollment at non-degree granting institutions is likely modest as measured enrollment at non-degree granting institutions was 376,761 relative to 18,659,851 at degree-granting institutions in 2021 (table 303.55, De Brey et al. (2021)).

Minimum wage data

Data on the minimum wage come from the state-level monthly minimum wage series described in Vaghul and Zipperer (2022). The series draws on state legislation and resolutions, federal reports from the Bureau of Labor Statistics, reports from state and local agencies, and communications from state labor departments.

As the outcomes of interest are enrollment and completion, which occur on the academic calendar timeline, relevant minimum wage changes occur in the academic year preceding the year of enrollment/completion. This is especially relevant for enrollment, which is measured in the fall in the IPEDS data. For example, regardless of whether a minimum wage change happened in December 2013 or January 2014, fall 2014 enrollment is the corresponding outcome of interest.[8] Thus, we align minimum wage changes with the academic year in which they occur rather than the calendar year. Rather than measure the enrollment response to a nominal change in the minimum wage (50 cents, 75 cents, etc.), we classify minimum wage changes by the size of the change in relation to the prevailing minimum wage. In section 5, we present estimates for minimum wage changes of at least 8%, and in the appendix we examine impacts of minimum wage changes that are at least 6% and 10%, with similar results especially in the first two years after the change. Any minimum wage change that is smaller than the given level is considered a "minor" change. Moving forward, we refer to "relevant" versus "minor" changes with relevance defined by the given level of change.

Many state minimum wage changes are minor. Between the academic years of 1986 and 2019, nearly 400 minimum wage changes occur at the state level; 170 of these were an 8% increase or larger. Many, but not all, states had minimum wage increases during the study period. The 14 states that had no relevant state-level minimum wage changes from 1986 to 2019 are largely concentrated in the South and Rocky Mountain regions of the United States. Further, the relevant minimum wage changes that identify our impacts tend to be fairly well-distributed across years. The frequency, temporal, and geographic distribution of minimum wage changes of different sizes

[8] Results are robust to using calendar year rather than academic year alignments.

can be seen in figures A.1, A.2, and A.3.

Additional outcomes and state characteristics

In order to test the robustness of our estimates, we collect additional state characteristics to serve as control variables. We use data from the American Community Survey and the CPS on the state-level population and age distribution as well as the racial composition of each state. Unemployment rate data come from the Bureau of Labor Statistics.

5 Results

We begin our analysis by documenting the impacts of minimum wage increases on enrollment by institution type, full vs. part-time enrollment status, and gender using the stacked event-study approach described above.

Enrollment Impacts

Figure 1 graphs event-study results for two- and four-year enrollment across all institutions (panel A) and public institutions only (panel B). In the year following a relevant minimum wage increase, two-year enrollment drops by just over 4% across all institutions. The enrollment decline is little changed over the subsequent years, and by year 5 two-year enrollment remains down by about 4%. There are no substantial or statistically significant pre-trends in two-year enrollment prior to the minimum wage event. In contrast, there is no change in enrollment at four-year degree-granting institutions after a minimum wage increase. As shown in Panel B, results are similar when the sample is limited to public institutions only, which account for 96% of two-year enrollment and 65% of four-year enrollment in 2021 (table 303.30, (De Brey et al. 2021)).[9] Setting broader or stricter thresholds for the size of the minimum wage changes constituting relevant changes (greater than 6% and greater than 10%) does not materially change the estimated declines in enrollment (figure A.5).

[9]These results are little changed when controls for racial and ethnic group-specific populations aged 18-30 included, see figure A.4.

[FIGURE 1 HERE]

Figure 2 repeats the event-study analysis separately for part-time (panel A) and full-time (panel B) enrollment in two- and four-year colleges in the public sector. Among two-year colleges, part-time enrollment (which comprises 60% of 2-year enrollment) drops by 6% in the year following a relevant minimum wage increase, and remains at that lower level through the end of the sample period. Among four-year colleges, part-time enrollment (which comprises 19% of 4-year enrollment) appears to swell a little, with enrollment up a marginally statistically significant 3% by year two after a relevant minimum wage change then indistinguishable from zero in subsequent years. The impacts of a relevant minimum wage increase are more muted on full-time enrollment in two-year institutions, but nonetheless there is a persistent 2% decline in two-year enrollment. Event-study estimates of four-year, full-time enrollment are small and statistically indistinguishable from zero.

[FIGURE 2 HERE]

We report difference-in-differences estimates of the impact of a relevant minimum wage increase on enrollment (through 5 years post-change) in table 1, adding estimates separately by gender.[10] While women are more likely than men to attend two-year institutions (comprising nearly 60% of enrollment at public two-year institutions), the enrollment response to a minimum wage change is indistinguishable across genders. Overall and for both full-time and part-time students, a minimum wage increase results in a statistically significant decrease in enrollment at two-year institutions. On the other hand, impacts on four-year enrollment are small and generally not statistically different from zero.

While limited data are available on enrollment at for-profit institutions over time, the absence of consistent state-by-year reporting suggests that any presentation of results should be accompanied by appropriate caution. For for-profit colleges (panel A of table A.8), there are imprecisely estimated negative impacts of minimum wage changes on enrollment.

[TABLE 1 HERE]

[10]Corresponding event-study coefficients for years 0 to 3 are shown in tables A.1 and A.4. In addition, tables A.2 and A.5 show specifications controlling only for state unemployment rate, and tables A.3 and A.6 show specifications with no state-year time-varying controls. The coefficients and statistical significance are little changed across specifications.

We also explore whether there are differences by racial/ethnic group in responses to minimum wage increases. In the first few years after a minimum wage increase, the point estimates on enrollment decline are somewhat larger among Hispanic students than among Black or White students, but the differences are not statistically significant. Results are quite similar for males and females in each racial/ethnic category (see figure A.7; figure A.8 shows results by racial/ethnic group separately by gender).

In summary, we find that minimum wage increases reduce enrollment at two-year colleges across the board—for full-time and part-time students and for men and women. The negative impact persists for at least 5 years after the minimum wage increase. Enrollment at four-year colleges is generally unchanged by minimum wage increases, and to the extent it is impacted it is a small, positive effect that quickly dissipates.

Attainment Impacts

It is still an open question to what extent minimum wage changes alter program completions in two-year colleges. Many students who enter two-year colleges do not complete a program. On average, only 35% of incoming certificate and associate degree-seeking students at two-year institutions complete the credential within 150% of the predicted time to completion. This completion rate is even lower—30%—at public two-year institutions (table 326.20, De Brey et al. (2021)). To the extent that a minimum wage increase deters enrollment among students unlikely to complete their program, the impact on social benefits may be different than if it significantly reduces degree/certificate attainment.

[FIGURE 3 HERE]

Figure 3 investigates the impact of a relevant minimum wage increase on degree completion in two-year colleges, separately for certificate programs and two-year associate (AA) degrees.[11] Despite the sizeable declines in enrollment at two-year colleges shown in the previous section, completions are unchanged. The results for AA degrees (in red) are precisely estimated and not

[11] Of all degree completions at two-year institutions in 2019, associate degree completions comprised approximately 56% of the total, whereas certificates of less than one year accounted for 27% and certificates of between one and two years accounted for 17% of the total. We combine the less than one year and on -to-two year certificates in our analysis. Note that coefficients and standard errors for figures 3 and 4 can be found in table A.7.

statistically significant in both the pre- and post-periods. While results for certificates are less precisely estimated, a null effect is in the confidence interval throughout. Completions of AA degrees trend down somewhat over time, but the effect of the minimum wage increase is never statistically significantly different from zero. Completions of certificates are unchanged throughout the sample period. Attainment effects, similar to enrollment effects, do not appear to be sensitive to the size of the minimum wage change in question. Associate degree attainment in response to minimum wage changes of 6%, 8%, and 10% is not significantly different from zero (see figure A.6).

Figure 4 shows the impact of a minimum wage increase on attainment separately by gender. As shown in panel A, although the impact on women's AA degree attainment grows somewhat over time, it is largely insignificant. Similarly, there are no measured changes in women's completions of certificates, though as in the overall sample certificate results are imprecisely estimated. As shown in panel B, there are no statistically significant impacts on men's completions of AA degrees or certificates, with certificate results again imprecise. Results are similar and not statistically different from zero for all groups by race/ethnicity both overall and separately by gender (see figures A.9 and A.10).

[FIGURE 4 HERE]

In summary, there is little evidence that minimum wage increases impact degree or certificate attainment overall or among men, even as minimum wage increases substantially reduce enrollment in two-year public institutions. Among women, while attainment impacts are generally insignificant there are some impacts on associate degree attainment that are weakly significant.

The broad question of our analysis concerns how increases in the minimum wage impact decisions of adults to invest in skill acquisition. In addition to post-secondary enrollment, other channels for skill investment for low-wage workers include completion of the the General Education Degree (GED) or participation in federal workforce development job training programs. Because these programs often serve low-wage workers and may require a tradeoff between employment and enrollment, participation may be impacted by an increase in the minimum wage. Using the

available data on GED taking, there is some negative impact on the number of individuals who take a GED exam in the years immediately following a minimum wage change, accompanied by smaller declines in the number of individuals to who score high enough to "pass" the GED exam, as shown in table A.9. For participation in federal job training (WIA and WIOA), there are modest — but imprecisely estimated — negative effects (table A.9). Data constraints (discussed in appendix section B) which restrict the years of observation limit conclusions about these these alternative channels for skill investment.

6 Mechanisms and Discussion

Analysis of the impact of state-level minimum wage changes on post-secondary enrollment and attainment produces convincing evidence of negative enrollment effects at community colleges, particularly among part-time students, with little corresponding impact on degree attainment. These enrollment estimates are quantitatively significant; using 8% as the magnitude of the minimum wage changes used in table 1, our estimates suggest an overall community college enrollment elasticity of -0.575 and a part-time enrollment elasticity of -0.762. To provide context, most estimates of the tuition price elasticity of enrollment demand are more modest, with the recent study from Denning (2017) presenting an elasticity of -0.29 as the impact of tuition changes on community college enrollment among those who have just graduated from high school.

While there are a number of other labor market and post-secondary factors that impact community college enrollment, large increases in the minimum wage over the last decade at the state and federal levels may be a contributing factor to the decline in aggregate community college enrollment evident over the last decade, which fell from 7.2 million in 2010 to 4.7 million in 2020 (table 303.25, De Brey et al. (2021)).

Whether the decline in community college enrollment caused by increases in minimum wages ultimately hurts (or helps) workers depends on whether workers forgo skill attainment and how such skills would have been valued by the labor market. There is some evidence of modest eco-

nomic returns to attendance and low levels of credit attainment even in the absence of degree attainment (Kane and Rouse 1995; Oreopoulos and Petronijevic 2013; Lovenheim and Smith 2022).

An interesting question raised by our evidence concerns how minimum wage changes and shifting participation in community college impact on-the-job training provided by firms. Essentially, are these activities complements or substitutes? In the context of canonical competitive labor market models, increasing the minimum wage reduces the firms' capacity to provide on-the-job training because firms can no longer finance the training through wage reductions given the minimum wage floor (Neumark and Wascher 2003). Alternatively, increasing the minimum wage in the presence of labor market frictions may generate incentives for firms to increase training, as firms are able to recoup some rents to the extent that the productivity gains from training exceed their cost of providing the training (Acemoglu and Pischke 1999).

While we lack the data to measure the impact of minimum wage changes on training provided by firms, this open question is of first-order importance in evaluating the impact on the minimum wage on the skill-development of workers. A case where both community college enrollment and on-the-job-training fall with a rising minimum wage would point to a decline in training participation, while the case represented by an increase in firm-provided training would indicate a shift in "who pays" for training, shifting the burden from workers (through tuition) and the government (through grant and appropriation subsidies) to firms.

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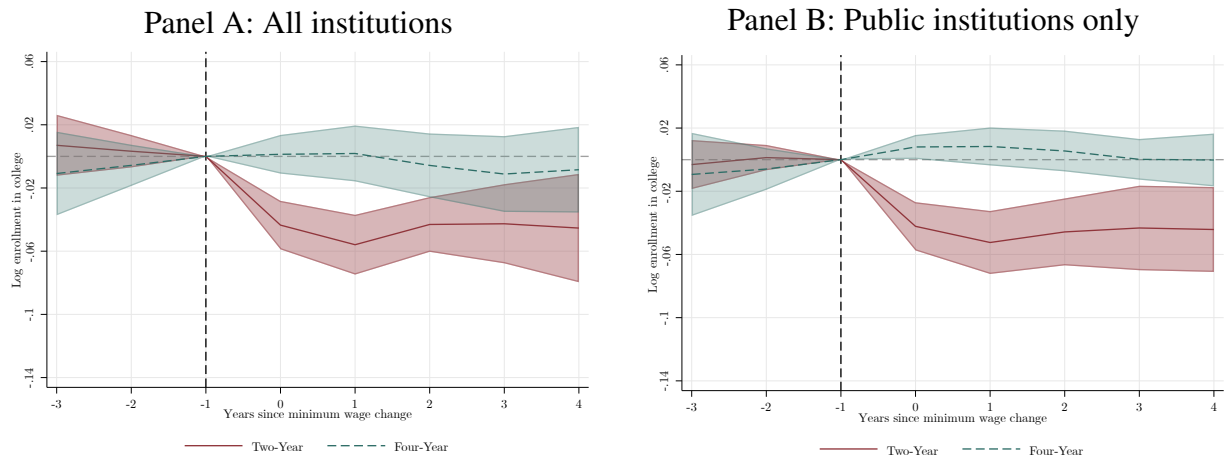
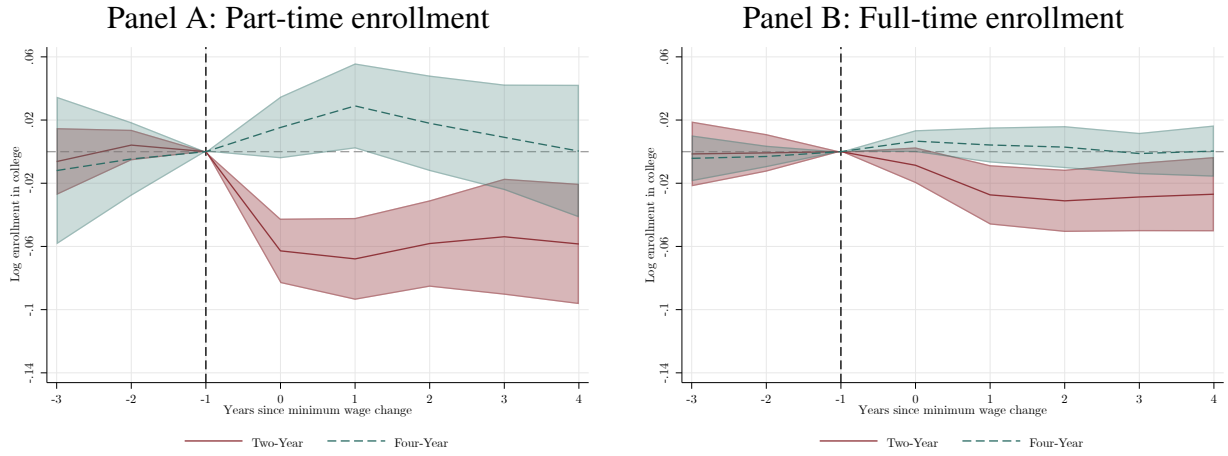
Figure 1: Impact of minimum wage change (8% or more) on post-secondary enrollment



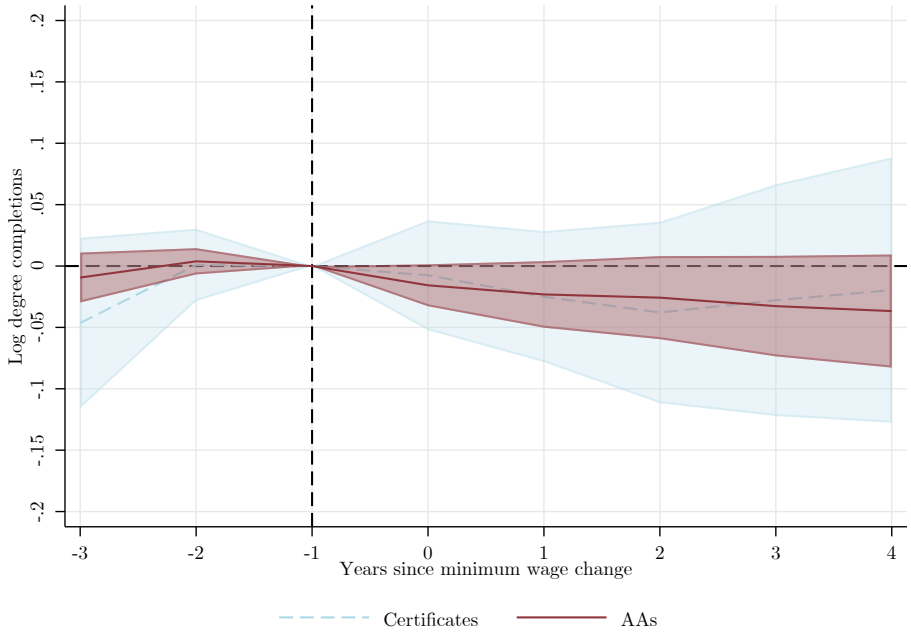
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in two- and four-year colleges. Panel A presents results for all institutions. Panel B presents results for only public institutions. The shaded region indicates 95% confidence intervals. Minimum wage changes are defined as an increase of 8% or more on the base. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. Red identifies changes in two-year college enrollment. Green identifies changes in four-year college enrollment. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure 2: Impact of minimum wage change (8% or more) on public part-time versus full-time enrollment



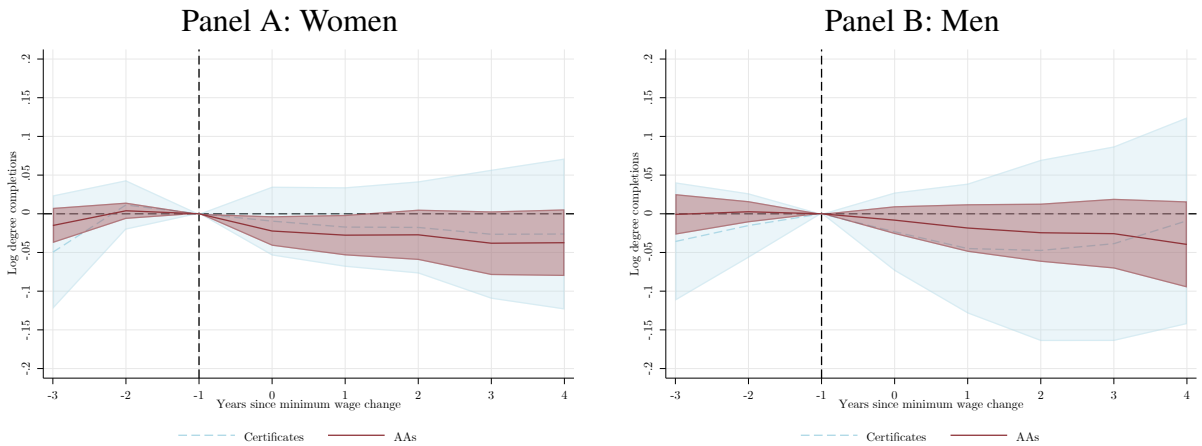
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in public two- and four-year colleges. Panel A presents results for part-time enrollment in public post-secondary institutions. Panel B presents results for full-time enrollment in public post-secondary institutions. The shaded region indicates the 95% confidence interval. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. Red identifies changes in two-year college enrollment. Green identifies changes in four-year college enrollment. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure 3: Impact of minimum wage change (8% or more) on attainment



Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on degree completions at public two-year institutions. The shaded region indicates 95% confidence intervals. Minimum wage changes are defined as an increase of 8% or more on the base. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. Red identifies changes in associate degree completion. Blue identifies changes in completion of certificates that take from less than one to two years to complete. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure 4: Impact of minimum wage change (8%) on attainment



Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on degree completions at public two-year institutions. Panel A presents results for women at public institutions. Panel B presents the same estimates for men. The shaded region indicates 95% confidence intervals. Minimum wage changes are defined as an increase of 8% or more on the base. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. Red identifies changes in associate degree completion. Blue identifies changes in completion of certificates that take from less than one to two years to complete. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

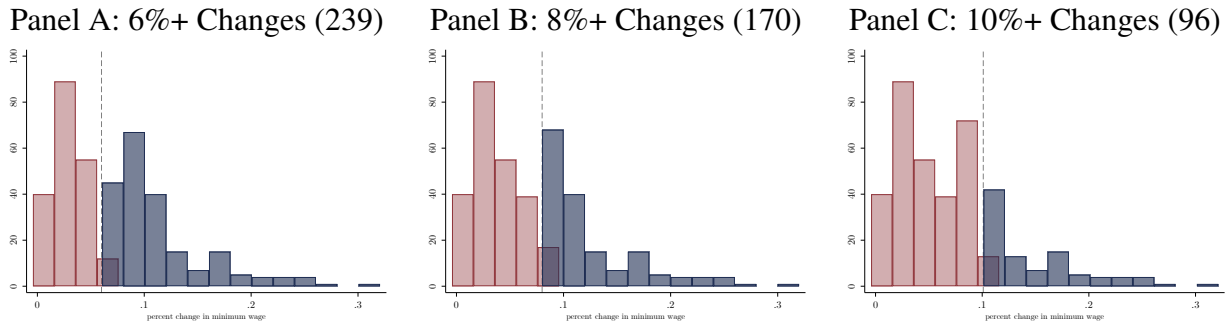
Table 1: Impact of minimum wage change (8% or more) on post-secondary enrollment

	Two-year enrollment			Four-year enrollment		
	Total	Men	Women	Total	Men	Women
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All Institutions						
Total enrollment	-0.046 ***	-0.046 ***	-0.048 ***	-0.003	0.000	-0.007
	(0.008)	(0.011)	(0.007)	(0.008)	(0.009)	(0.007)
Full-time enrollment	-0.033 ***	-0.026 ***	-0.037 ***	-0.003	-0.002	-0.004
	(0.009)	(0.009)	(0.010)	(0.005)	(0.005)	(0.004)
Part-time enrollment	-0.045 ***	-0.051 ***	-0.043 ***	-0.006	0.002	-0.013
	(0.012)	(0.018)	(0.010)	(0.025)	(0.028)	(0.023)
Panel B: Public Institutions						
Total enrollment	-0.046 ***	-0.052 ***	-0.043 ***	0.006	0.007	0.004
	(0.009)	(0.013)	(0.007)	(0.005)	(0.005)	(0.004)
Full-time enrollment	-0.024 ***	-0.024 ***	-0.026 ***	0.003	0.004	0.002
	(0.008)	(0.008)	(0.008)	(0.005)	(0.005)	(0.004)
Part-time enrollment	-0.061 ***	-0.072 ***	-0.054 ***	0.018	0.015	0.019
	(0.012)	(0.018)	(0.010)	(0.011)	(0.011)	(0.012)

Notes: This table gives the results of a stacked difference-in-difference measuring the impact of a state-level minimum wage increase on enrollment in two- and four-year colleges in the post-period after the change. Standard errors are given in parentheses. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

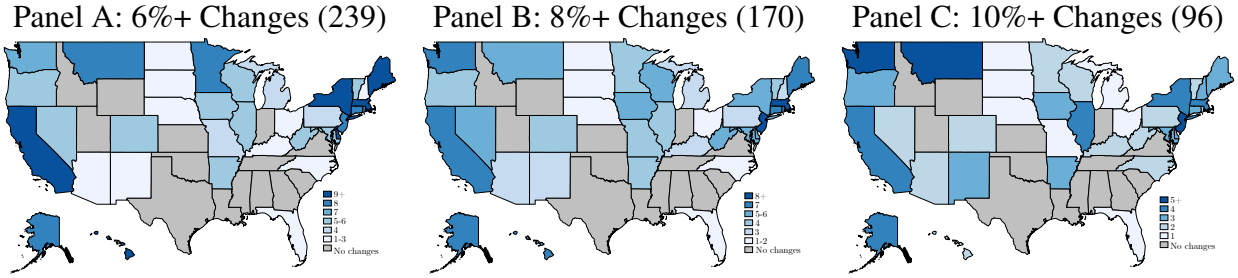
A Appendix

Figure A.1: Minimum Wage Change Histograms



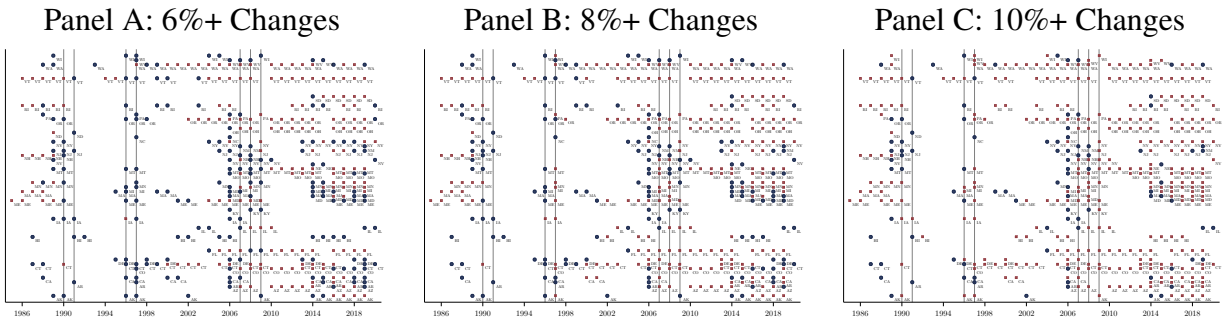
Notes: This figure shows histograms of all minimum wage changes from 1986 to 2019. In each of the three panels, blue indicates relevant minimum wage changes, while red indicates minor minimum wage changes. The grey line indicates the given threshold (6%, 8%, or 10%). The total number of relevant changes above each threshold is given in parentheses: 239, 170, and 96.

Figure A.2: Minimum Wage Change Maps



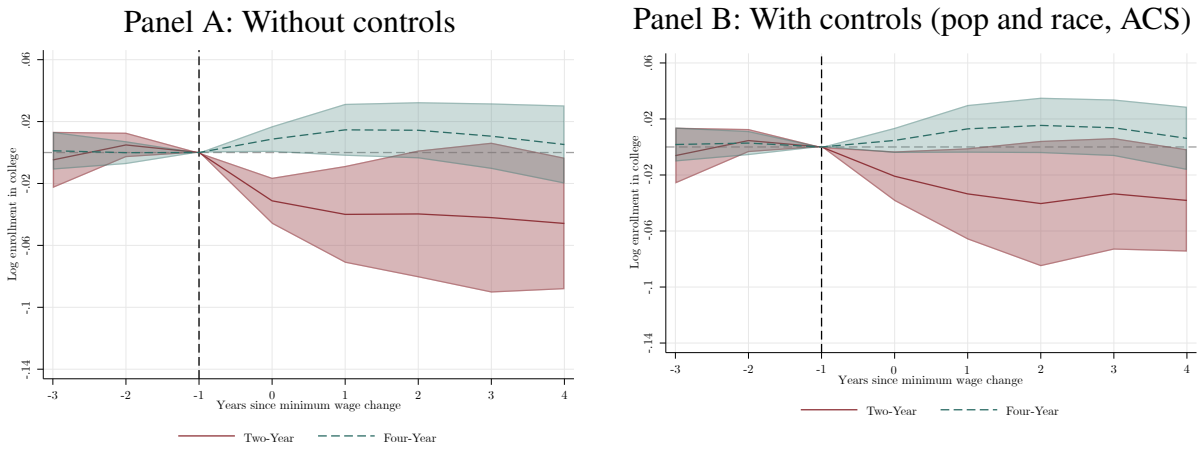
Notes: This figure shows maps of all minimum wage changes from 1986 to 2019. In each of the three panels, darker shades of blue indicate a higher number of relevant minimum wage changes. The grey line indicates the given threshold (6%, 8%, or 10%). The total number of relevant changes above each threshold is given in parentheses: 239, 170, and 96.

Figure A.3: Minimum Wage Change Timelines



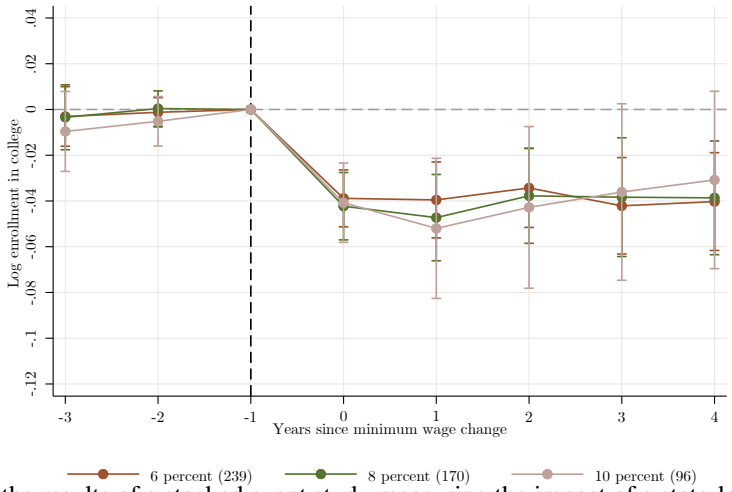
Notes: This figure shows timelines of all minimum wage changes from 1986 to 2019 across states in the U.S. Relevant minimum wage changes, defined by the given percent change in the minimum wage, are shown as blue circles, whereas red squares indicate minor minimum wage changes. Grey lines represent federal changes to the minimum wage.

Figure A.4: Main event study on completion, with ACS controls (2000-2019)



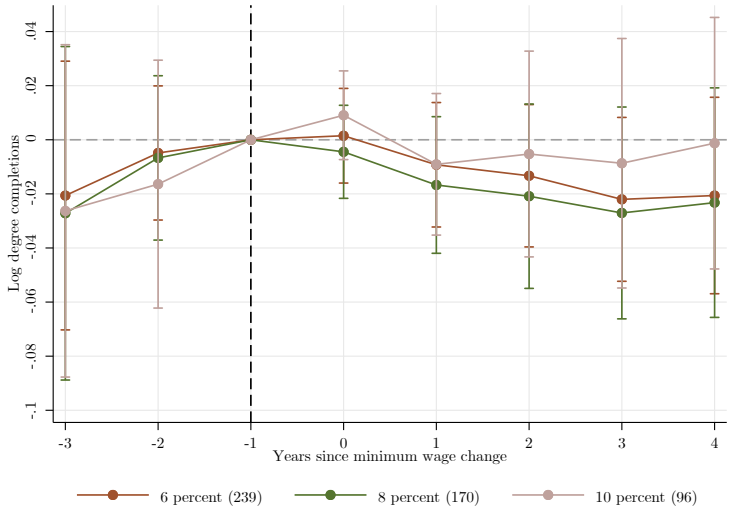
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on post-secondary enrollment at public institutions. Panel A presents results using the traditional stacked event study. Panel B presents estimates from the stacked event study including controls for unemployment rate and log population (ages 18-30), and racial breakdown (percentages) of the 18-30 year-old population. Data from 2000-2019 are used. The shaded region indicates 95% confidence intervals. Minimum wage changes are defined as an increase of 8% or more on the base. Standard errors are clustered at the state level.

Figure A.5: Impact of minimum wage changes on two-year enrollment by change size



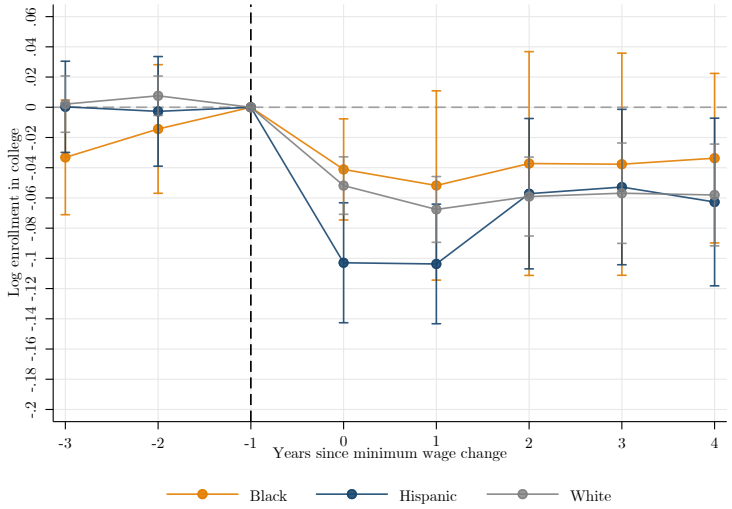
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in public two-year colleges. Minimum wage change sizes of 6% or greater, 8% or greater, and 10% or greater are used. Whiskers indicate the 95% confidence interval. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure A.6: Impact of minimum wage changes on associate degree completion by change size



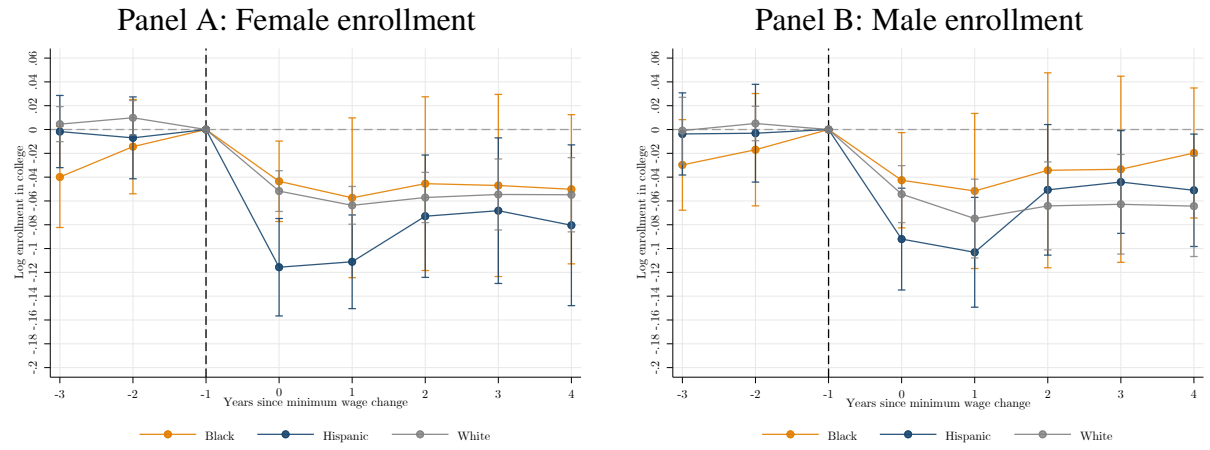
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on associate degree completion at public two-year colleges. Minimum wage change sizes of 6% or greater, 8% or greater, and 10% or greater are used. Whiskers indicate the 95% confidence interval. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure A.7: Impact of minimum wage change (8%) on two-year enrollment by race/ethnicity



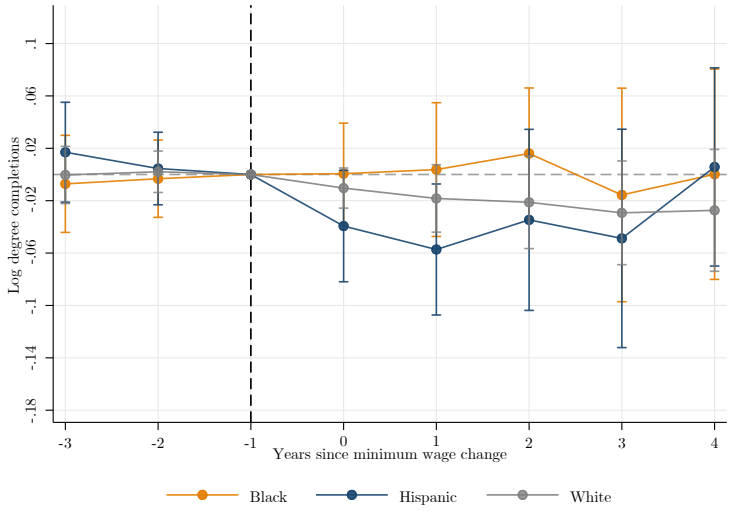
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in public two-year colleges by race. Part-time and full-time enrollments are included. Whiskers indicate the 95% confidence interval. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure A.8: Impact of minimum wage change (8%) on two-year enrollment by race/ethnicity and gender



Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in public two-year colleges by race. Panel A presents results for female enrollment in public institutions. Panel B presents results for male enrollment in public institutions. Race is coded by IPEDS. Part-time and full-time enrollments are included. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Whiskers indicate the 95% confidence interval. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

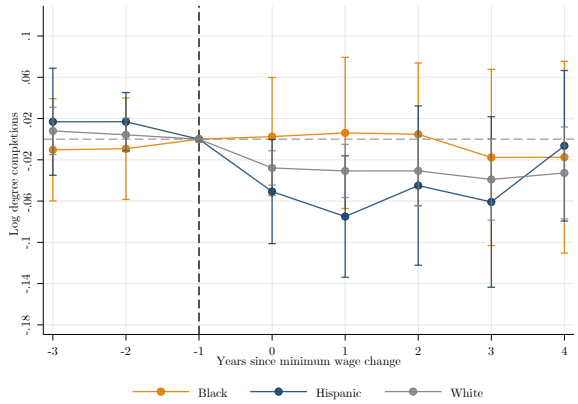
Figure A.9: Impact of minimum wage change (8%) on associate degree completions by race/ethnicity



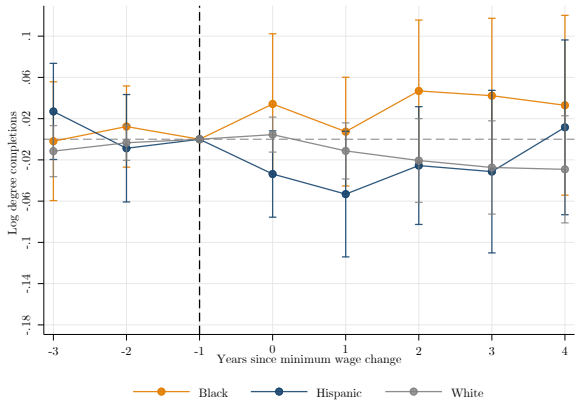
Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on completion of associate degrees at public two-year colleges by race. Race is coded by IPEDS, and data from 1996-2019 are used. Controls for unemployment rate and log state population aged 18-30 are included. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Whiskers indicate the 95% confidence interval. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure A.10: Impact of minimum wage change (8%) on associate degree completion by race/ethnicity and gender

Panel A: Female associate degree completions

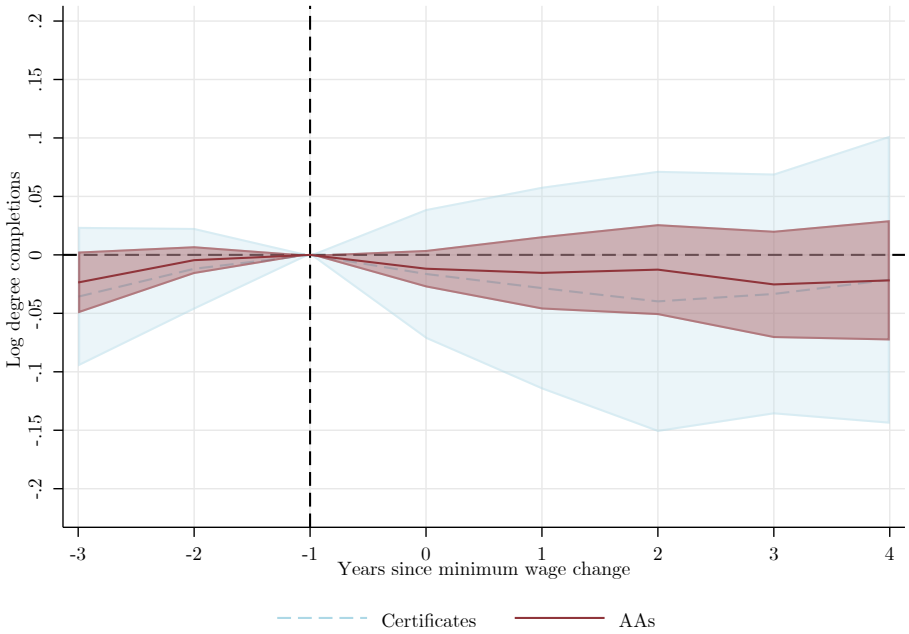


Panel B: Male associate degree completions



Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on completion of associate degrees at public two-year colleges by race and gender. Panel A presents results for female enrollments. Panel B presents results for male completions. Race is coded by IPEDS and data from 1996-2019 are used. Controls for unemployment rate and log state population aged 18-30 are included. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Whiskers indicate the 95% confidence interval. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Figure A.11: Impact of minimum wage change (8% or more) on attainment



Notes: This figure plots the results of a stacked event study measuring the impact of a state-level minimum wage increase on degree completions at public two-year institutions. The shaded region indicates 95% confidence intervals. Minimum wage changes are defined as an increase of 8% or more on the base. Standard errors are clustered at the state level. Controls for unemployment rate and log state population aged 18-30 are included. Data from 2000-2019 are used. Red identifies changes in associate degree completion. Blue identifies changes in completion of certificates that take from less than one to two years to complete. The black dashed line identifies the year before the change took place. Year 0 identifies the first academic year with an increased minimum wage.

Table A.1: Impact of minimum wage change (8% or more) on two-year enrollment

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	-0.043 ***	-0.056 ***	-0.043 ***	-0.043 ***	-0.041 ***	-0.057 ***	-0.043 ***	-0.043 ***	-0.046 ***	-0.057 ***	-0.044 ***	-0.045 ***
	(0.008)	(0.009)	(0.009)	(0.012)	(0.009)	(0.012)	(0.013)	(0.015)	(0.007)	(0.009)	(0.007)	(0.012)
Full-time enrollment	-0.016 **	-0.038 ***	-0.034 ***	-0.041 ***	-0.012	-0.033 ***	-0.027 ***	-0.034 ***	-0.018 **	-0.042 ***	-0.040 ***	-0.047 ***
	(0.008)	(0.012)	(0.010)	(0.013)	(0.007)	(0.012)	(0.010)	(0.013)	(0.009)	(0.013)	(0.010)	(0.014)
Part-time enrollment	-0.051 ***	-0.053 ***	-0.040 ***	-0.035 *	-0.056 ***	-0.062 ***	-0.047 **	-0.040 *	-0.050 ***	-0.049 ***	-0.037 ***	-0.034 *
	(0.010)	(0.014)	(0.013)	(0.020)	(0.014)	(0.020)	(0.020)	(0.024)	(0.009)	(0.011)	(0.010)	(0.019)
Panel B: Public Institutions												
Total enrollment	-0.042 ***	-0.052 ***	-0.046 ***	-0.043 ***	-0.046 ***	-0.060 ***	-0.052 ***	-0.048 ***	-0.040 ***	-0.048 ***	-0.042 ***	-0.041 ***
	(0.008)	(0.010)	(0.010)	(0.013)	(0.010)	(0.014)	(0.015)	(0.016)	(0.006)	(0.007)	(0.009)	(0.012)
Full-time enrollment	-0.009	-0.027 ***	-0.031 ***	-0.029 ***	-0.011	-0.029 ***	-0.030 ***	-0.027 **	-0.007	-0.028 ***	-0.035 ***	-0.033 ***
	(0.006)	(0.009)	(0.010)	(0.011)	(0.006)	(0.010)	(0.009)	(0.011)	(0.005)	(0.009)	(0.010)	(0.012)
Part-time enrollment	-0.063 ***	-0.068 ***	-0.058 ***	-0.054 ***	-0.071 ***	-0.082 ***	-0.072 ***	-0.064 ***	-0.059 ***	-0.060 ***	-0.051 ***	-0.048 ***
	(0.010)	(0.013)	(0.013)	(0.018)	(0.014)	(0.020)	(0.020)	(0.023)	(0.008)	(0.009)	(0.011)	(0.016)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in two-year colleges in the first four years after the change. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.2: Impact of minimum wage change (8% or more) on two-year enrollment: Controls for unemployment rate only

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	-0.042 ***	-0.055 ***	-0.042 ***	-0.040 ***	-0.040 ***	-0.055 ***	-0.042 ***	-0.040 ***	-0.046 ***	-0.056 ***	-0.044 ***	-0.044 ***
	(0.008)	(0.009)	(0.009)	(0.012)	(0.009)	(0.012)	(0.013)	(0.015)	(0.007)	(0.009)	(0.007)	(0.012)
Full-time enrollment	-0.019 **	-0.040 ***	-0.037 ***	-0.047 ***	-0.015 *	-0.035 ***	-0.029 ***	-0.040 ***	-0.021 **	-0.044 ***	-0.043 ***	-0.052 ***
	(0.008)	(0.013)	(0.010)	(0.014)	(0.008)	(0.012)	(0.010)	(0.013)	(0.009)	(0.014)	(0.011)	(0.014)
Part-time enrollment	-0.048 ***	-0.051 ***	-0.037 ***	-0.028	-0.051 ***	-0.058 ***	-0.043 **	-0.031	-0.048 ***	-0.048 ***	-0.035 ***	-0.029
	(0.010)	(0.014)	(0.014)	(0.020)	(0.014)	(0.020)	(0.020)	(0.024)	(0.009)	(0.011)	(0.011)	(0.018)
Panel B: Public Institutions												
Total enrollment	-0.040 ***	-0.051 ***	-0.043 ***	-0.038 ***	-0.043 ***	-0.058 ***	-0.050 ***	-0.043 ***	-0.038 ***	-0.046 ***	-0.040 ***	-0.035 ***
	(0.007)	(0.009)	(0.010)	(0.013)	(0.010)	(0.014)	(0.015)	(0.016)	(0.006)	(0.007)	(0.009)	(0.013)
Full-time enrollment	-0.010 *	-0.028 ***	-0.033 ***	-0.032 ***	-0.013 *	-0.030 ***	-0.031 ***	-0.031 ***	-0.008	-0.029 ***	-0.037 ***	-0.036 ***
	(0.006)	(0.010)	(0.010)	(0.011)	(0.007)	(0.011)	(0.010)	(0.011)	(0.006)	(0.010)	(0.011)	(0.012)
Part-time enrollment	-0.060 ***	-0.066 ***	-0.055 ***	-0.047 ***	-0.067 ***	-0.079 ***	-0.068 ***	-0.056 **	-0.056 ***	-0.058 ***	-0.048 ***	-0.042 ***
	(0.010)	(0.013)	(0.014)	(0.018)	(0.013)	(0.019)	(0.020)	(0.023)	(0.008)	(0.009)	(0.011)	(0.016)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in two-year colleges in the first four years after the change. Controls for unemployment rate are included. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.3: Impact of minimum wage change (8% or more) on two-year enrollment: No state-year time-varying controls

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	-0.042 ***	-0.054 ***	-0.038 ***	-0.034 ***	-0.039 ***	-0.054 ***	-0.038 ***	-0.034 **	-0.045 ***	-0.055 ***	-0.040 ***	-0.038 ***
	(0.008)	(0.010)	(0.009)	(0.012)	(0.009)	(0.012)	(0.013)	(0.015)	(0.008)	(0.009)	(0.007)	(0.012)
Full-time enrollment	-0.019 **	-0.038 ***	-0.031 ***	-0.038 ***	-0.014 *	-0.033 ***	-0.024 **	-0.032 **	-0.020 **	-0.042 ***	-0.036 ***	-0.042 ***
	(0.008)	(0.012)	(0.010)	(0.013)	(0.008)	(0.011)	(0.010)	(0.013)	(0.009)	(0.013)	(0.010)	(0.013)
Part-time enrollment	-0.048 ***	-0.049 ***	-0.033 **	-0.022	-0.051 ***	-0.057 ***	-0.039 *	-0.025	-0.048 ***	-0.046 ***	-0.031 ***	-0.023
	(0.011)	(0.014)	(0.014)	(0.020)	(0.014)	(0.020)	(0.020)	(0.024)	(0.009)	(0.012)	(0.011)	(0.018)
Panel B: Public Institutions												
Total enrollment	-0.040 ***	-0.049 ***	-0.040 ***	-0.032 **	-0.043 ***	-0.057 ***	-0.046 ***	-0.038 **	-0.038 ***	-0.045 ***	-0.036 ***	-0.029 **
	(0.007)	(0.009)	(0.010)	(0.013)	(0.010)	(0.013)	(0.014)	(0.016)	(0.006)	(0.007)	(0.009)	(0.012)
Full-time enrollment	-0.011 *	-0.027 ***	-0.027 ***	-0.025 **	-0.013 *	-0.029 ***	-0.026 ***	-0.025 **	-0.009	-0.027 ***	-0.032 ***	-0.030 **
	(0.006)	(0.009)	(0.009)	(0.011)	(0.007)	(0.009)	(0.009)	(0.011)	(0.006)	(0.009)	(0.010)	(0.012)
Part-time enrollment	-0.059 ***	-0.064 ***	-0.052 ***	-0.042 **	-0.066 ***	-0.078 ***	-0.065 ***	-0.051 **	-0.056 ***	-0.057 ***	-0.045 ***	-0.037 **
	(0.010)	(0.013)	(0.014)	(0.019)	(0.013)	(0.019)	(0.020)	(0.024)	(0.008)	(0.010)	(0.011)	(0.017)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in two-year colleges in the first four years after the change. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.4: Impact of minimum wage change (8% or more) on four-year enrollment

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	0.001	0.002	-0.006	-0.011	0.004	0.006	-0.002	-0.007	-0.001	-0.001	-0.009	-0.016
	(0.006)	(0.009)	(0.010)	(0.012)	(0.006)	(0.009)	(0.012)	(0.015)	(0.007)	(0.009)	(0.009)	(0.010)
Full-time enrollment	0.002	0.000	-0.004	-0.010	0.004	0.002	-0.003	-0.009	0.001	-0.001	-0.006	-0.012 *
	(0.004)	(0.006)	(0.006)	(0.006)	(0.004)	(0.006)	(0.007)	(0.008)	(0.004)	(0.006)	(0.006)	(0.006)
Part-time enrollment	-0.002	0.005	-0.011	-0.016	0.002	0.012	-0.002	-0.005	-0.005	-0.002	-0.020	-0.025
	(0.017)	(0.024)	(0.032)	(0.041)	(0.016)	(0.024)	(0.036)	(0.048)	(0.018)	(0.025)	(0.028)	(0.035)
Panel B: Public Institutions												
Total enrollment	0.008 **	0.008	0.006	0.000	0.010 **	0.010	0.006	0.000	0.006 *	0.007	0.005	-0.001
	(0.004)	(0.006)	(0.006)	(0.006)	(0.004)	(0.007)	(0.007)	(0.007)	(0.004)	(0.006)	(0.006)	(0.006)
Full-time enrollment	0.007 *	0.004	0.003	-0.001	0.008 **	0.005	0.002	-0.001	0.006 *	0.003	0.003	-0.002
	(0.003)	(0.005)	(0.007)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.003)	(0.005)	(0.006)	(0.006)
Part-time enrollment	0.015	0.029 **	0.018	0.009	0.015	0.028 **	0.014	0.004	0.016	0.029 **	0.020	0.012
	(0.010)	(0.013)	(0.015)	(0.016)	(0.010)	(0.014)	(0.015)	(0.015)	(0.010)	(0.014)	(0.016)	(0.019)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in non-profit four-year colleges in the first four years after the change. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.5: Impact of minimum wage change (8% or more) on four-year enrollment: Controls for unemployment rate only

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	0.001	0.002	-0.006	-0.012	0.004	0.005	-0.002	-0.007	-0.001	-0.002	-0.010	-0.017 *
	(0.006)	(0.009)	(0.010)	(0.012)	(0.005)	(0.009)	(0.012)	(0.015)	(0.007)	(0.009)	(0.009)	(0.010)
Full-time enrollment	0.000	-0.001	-0.006	-0.014 *	0.002	0.001	-0.005	-0.012	-0.001	-0.002	-0.007	-0.015 **
	(0.004)	(0.006)	(0.007)	(0.007)	(0.004)	(0.006)	(0.008)	(0.009)	(0.005)	(0.007)	(0.007)	(0.007)
Part-time enrollment	0.002	0.007	-0.008	-0.008	0.006	0.015	0.002	0.004	-0.002	0.000	-0.017	-0.019
	(0.017)	(0.026)	(0.032)	(0.041)	(0.016)	(0.026)	(0.036)	(0.048)	(0.018)	(0.026)	(0.029)	(0.035)
Panel B: Public Institutions												
Total enrollment	0.008 **	0.008	0.006	0.000	0.010 **	0.010	0.005	0.000	0.006 *	0.007	0.005	0.000
	(0.004)	(0.006)	(0.006)	(0.006)	(0.004)	(0.007)	(0.007)	(0.007)	(0.004)	(0.006)	(0.006)	(0.006)
Full-time enrollment	0.005	0.003	0.002	-0.004	0.006 *	0.004	0.001	-0.003	0.005 *	0.003	0.002	-0.004
	(0.004)	(0.006)	(0.007)	(0.006)	(0.004)	(0.007)	(0.008)	(0.008)	(0.004)	(0.006)	(0.007)	(0.006)
Part-time enrollment	0.020 *	0.032 **	0.022	0.018	0.019 *	0.031 **	0.018	0.013	0.021 *	0.032 **	0.024	0.021
	(0.010)	(0.014)	(0.016)	(0.019)	(0.010)	(0.014)	(0.016)	(0.017)	(0.011)	(0.015)	(0.017)	(0.022)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in non-profit four-year colleges in the first four years after the change. Controls for unemployment rate are included. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.6: Impact of minimum wage change (8% or more) on four-year enrollment: No state-year time-varying controls

	Total				Men				Women			
	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3	Year t+0	Year t+1	Year t+2	Year t+3
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)
Panel A: All Institutions												
Total enrollment	0.001	0.003	-0.001	-0.005	0.004	0.007	0.002	-0.001	-0.001	0.000	-0.005	-0.008
	(0.005)	(0.008)	(0.010)	(0.013)	(0.005)	(0.008)	(0.012)	(0.016)	(0.006)	(0.008)	(0.008)	(0.010)
Full-time enrollment	0.001	0.001	-0.001	-0.006	0.003	0.002	0.000	-0.006	0.000	0.000	-0.002	-0.007
	(0.004)	(0.006)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)	(0.008)	(0.004)	(0.006)	(0.006)	(0.006)
Part-time enrollment	0.002	0.010	-0.001	0.002	0.006	0.017	0.008	0.013	-0.002	0.003	-0.009	-0.007
	(0.017)	(0.025)	(0.033)	(0.042)	(0.016)	(0.026)	(0.037)	(0.049)	(0.018)	(0.025)	(0.029)	(0.036)
Panel B: Public Institutions												
Total enrollment	0.008 **	0.010 *	0.012 *	0.009	0.010 **	0.012 *	0.011	0.008	0.006 *	0.009 *	0.012 **	0.010 *
	(0.003)	(0.005)	(0.006)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.003)	(0.005)	(0.006)	(0.006)
Full-time enrollment	0.005	0.005	0.008	0.005	0.006 *	0.005	0.006	0.004	0.004 *	0.005	0.008	0.005
	(0.003)	(0.005)	(0.007)	(0.007)	(0.004)	(0.006)	(0.007)	(0.008)	(0.003)	(0.005)	(0.006)	(0.006)
Part-time enrollment	0.020 **	0.035 **	0.031 *	0.032 *	0.019 *	0.034 **	0.027	0.026	0.021 **	0.036 **	0.034 *	0.035 *
	(0.010)	(0.015)	(0.017)	(0.018)	(0.010)	(0.015)	(0.016)	(0.016)	(0.010)	(0.016)	(0.018)	(0.021)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on enrollment in non-profit four-year colleges in the first four years after the change. Data from 1986-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.7: Impact of minimum wage change (8% or more) on attainment

	Year t+0 (1)	Year t+1 (2)	Year t+2 (3)	Year t+3 (4)
Panel A: Total				
Associate degrees	-0.013	-0.023 *	-0.027	-0.032
	(0.009)	(0.013)	(0.017)	(0.020)
Certificates	-0.008	-0.025	-0.038	-0.028
	(0.022)	(0.026)	(0.036)	(0.046)
Panel B: Men				
Associate degrees	-0.005	-0.018	-0.026	-0.025
	(0.009)	(0.015)	(0.019)	(0.022)
Certificates	-0.022	-0.045	-0.048	-0.038
	(0.025)	(0.041)	(0.058)	(0.063)
Panel C: Women				
Associate degrees	-0.020 *	-0.027 *	-0.028 *	-0.037 *
	(0.010)	(0.013)	(0.016)	(0.020)
Certificates	-0.011	-0.017	-0.017	-0.027
	(0.022)	(0.025)	(0.029)	(0.040)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on degree completions at public, two-year institutions. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.8: Impact of minimum wage change (8% or more) for-profit enrollment and attainment

	All (1)		Men (2)	Women (3)
Panel A. Enrollment				
All institutions	-0.005		-0.012	-0.005
	(0.087)		(0.105)	(0.078)
Two-year institutions	-0.023		-0.048	-0.019
	(0.061)		(0.063)	(0.062)
Panel B. AA Completions				
All institutions	-0.082		-0.087	-0.074
	(0.072)		(0.098)	(0.064)
Two-year institutions	-0.093	*	-0.067	-0.102
	(0.058)		(0.073)	(0.058)

Notes: This table gives the results of a difference-in-differences estimate of the impact of a state-level minimum wage increase on enrollment and associate degree completions at for-profit institutions. Controls for unemployment rate and log state population aged 18-30 are included. Data from 1996-2019 are used. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level.

Table A.9: Impact of minimum wage change (8% or more) on WIA and GED

	Year t+0 (1)	Year t+1 (2)	Year t+2 (3)	Year t+3 (4)
Panel A. WIOA Exiters				
Adults	-0.045	-0.044	0.121	0.127
	(0.102)	(0.113)	(0.123)	(0.133)
Youth	-0.050 *	-0.030	-0.028	-0.023
	(0.028)	(0.037)	(0.049)	(0.055)
Dislocated workers	0.055	0.084	0.123	0.087
	(0.050)	(0.067)	(0.102)	(0.111)
Panel B. GED Takers				
Completers	-0.053 **	-0.045 *	-0.009	-0.050
	(0.025)	(0.034)	(0.050)	(0.037)
Passers	-0.036 ***	-0.018	0.012	-0.029
	-(0.018)	(0.035)	(0.049)	(0.033)

Notes: This table gives the results of a stacked event study measuring the impact of a state-level minimum wage increase on completion of WIA programs as well as completion and passing rates of GED exams. Controls for unemployment rate and log state population aged 18-30 are included. Standard errors are given in parentheses. Minimum wage changes are defined as an increase of 8% or more on the base minimum wage. Standard errors are clustered at the state level. GED data used are 1991-2013 and WIA data are 2001-2019.

Table A.10: Data coverage across years by type of institution

	Public		For-Profits	
	Two-Years	Four-Years	Two-Years	Four-Years
	(1)	(2)	(3)	(4)
1986	50	50	41	12
1987	50	50	41	20
1988	50	50	41	20
1989	50	50	41	21
1990	50	50	41	21
1991	50	50	41	23
1992	50	50	41	24
1993	50	50	43	25
1994	50	50	44	25
1995	50	50	48	28
1996	50	50	48	27
1997	50	50	47	28
1998	50	50	47	26
1999	50	50	46	24
2000	50	50	46	24
2001	50	50	46	23
2002	50	50	46	24
2003	50	50	46	26
2004	50	50	45	30
2005	50	50	46	34
2006	50	50	46	39
2007	50	50	46	42
2008	50	50	46	42
2009	50	50	46	43
2010	50	50	46	43
2011	50	50	47	44
2012	50	50	47	42
2013	50	50	48	42
2014	50	50	48	42
2015	50	50	48	42
2016	50	50	47	40
2017	50	50	48	39
2018	50	50	47	36
2019	50	50	46	34

Notes: This table shows the number of states per year that have non-zero enrollment and completions data. 50 states is full-count, because we exclude DC. Any value less than 50 means indicates missing or zero data in that year by type of institution.

B Data Appendix

B.1 IPEDS Data

Enrollment

Institution-level enrollment data come from IPEDS and are available from 1986. We use 1986-2019 data to avoid confounding COVID-19 effects in 2020-2021. Data are consistently reported across years, but institutions are included even if they fail to report in a given year. Results are unchanged when using a balanced panel of institutions. Fall enrollment is used: these data are collected for all students enrolled in credit-bearing courses/programs which could potentially lead to awards. These data include full and part-time enrolled students. Full- and part-time students are separated or combined as noted in exhibit notes. Race of enrolled students is harmonized over time to reflect coarse categories of white, black, and Hispanic students. Appendix Figures A.7 and A.8 use data from 1996-2019 because the IPEDS race variable is collected only every other year before 1996.

Completions

Completions data come from IPEDS and are available at several *undergraduate* levels: certificates of less than one year, certificates of between one and two years, certificates of longer than two years, associate degrees, and bachelor's degrees. We only use undergraduate degrees. Although associate and bachelor's degrees are reported consistently since 1986, the NCES does not report certificates before 1996. Figures 3 and 4 use data from 1996 onward, and given inconsistency in reporting in the late 1990s, appendix figure A.11 shows completions using only 2000-2019. The results are largely comparable.

Throughout the paper, completions data combine certificates of less than one and one to two years. We also limit the results to credentials offered by "two-year" schools. Increasingly, four-year institutions are beginning to offer short certificates at the 1-2 year length. Given the com-

parison to associate degrees, and given that enrollment declines are seen at the two-year level, we restrict credentials to those offered by two-year institutions in the completions results.

B.2 GED and WIA data

Data on GED completion are collected from GED testing services annual reports. These reports are available from 1991-2013. After 2013, data on GED takers and passers are not consistently available at the state level. We therefore limit our GED data use to 1991-2013.

The Department of Labor sponsors some job-training activities, with Workforce Investment Act of 1998 (WIA) and the subsequent Workforce Innovation and Opportunity Act (WIOA) of 2014 funding these activities. Data on state-level participation in federally sponsored job-training programs are from Barnow, Miller and Smith (2021). These data cover 2000 through 2019.